The Value of Collaboration as a Function of Feedback for Managerial Learning

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ABSTRACT

This study aims to examine whether and how group-based, collaborative learning improves decision performance and transfer of learning in the context of a multi-period decision setting where the accounting system provides different types of feedback. Using both cognitive and motivational theoretical frameworks, collaboration is expected to positively influence learning through elaboration and increased motivation, which are facilitated by group discussion. Potential group information-processing advantage is assessed under different feedback conditions that are expected to influence the extent of learning. The study contributes to prior literature by addressing the lack of research examining group information-processing, particularly with respect to learning, and how it interacts with management accounting information. The findings of this study are expected to have practical implications for the design of management accounting information systems by highlighting the role of collaboration in learning and its value as a function of information that is made available to managers.
1. INTRODUCTION

Collaboration with others represents an integral part of everyday human activities. Contemporary organisational structures increasingly rely on team-based projects, contributing to a greater need for a more thorough understanding of their likely consequences. At the most profitable car manufacturer and the world’s biggest automaker, Toyota’s philosophy of continuous improvement relies on a thousand small collaborations (Evans & Wolf 2005; Stewart & Raman 2007). Their groups of engineers are known to “ask why five times” to trace causes and effects back to the roots of a problem. Their project teams are given autonomy to use resources, make purchase decisions, and pursue priorities. In relation to this critical success factor, Toyota’s president Fujio Cho remarked (Evans & Wolf 2005, p. 104), “Detroit people are far more talented than people at Toyota. But we take averagely talented people and make them work as spectacular teams.”

Collections of individuals working together for a common goal as teams have formed a central part of our social organisation. In organisations, the focus on the concept of work as an assemblage of individual jobs has shifted to a focus on teamwork as a result of efforts by organisations worldwide to restructure work around teams (Kozlowski & Ilgen 2006). This shift is driven by a variety of forces including increasing competition and consolidation which create pressures for skill diversity, rapid response, greater expertise, creativity, and adaptability (Kozlowski et al. 1999). Fast acting, temporary project teams are common within many organisations (Cohen & Bailey 1997; Sundstrom et al. 2000), representing one third of all teams operating in the United States (Gordon 1992).

Correspondingly, a succession of authors have called for more research which provides insights into how variations in management accounting practices influence group decision processes and outcomes (Scott & Tiessen 1999; Fisher et al. 2003; Sprinkle 2003; Rowe 2004; Coletti et al. 2005). Examining how groups may improve decision performance is of considerable importance as the use of teams as decision-making units is increasingly being relied upon by organisations to make important judgments with respect to resource allocation decisions (Chalos & Poon 2000; Martell & Leavitt 2002; Payne & Wood 2002). With the aim of answering recent calls for research that examines group decision-making and how it might interact with management accounting information (e.g. Sprinkle 2003), this study focuses on comparing group versus individual performance in a multi-period learning task and how different types of feedback affect groups’ ability to outperform individuals in terms of learning and the transfer of learning.

Concomitant with the increasing use of collaborations, an ongoing controversy in the decision making literature involves the extent to which group performance may exceed individual performance and the extent to which superior performance is attainable in practice (Trotman et al. 1983; Kozlowski & Ilgen 2006). On an applied level, using groups to make decisions is likely to be a more costly alternative to individual decision-making. Reviews of research findings by and large indicate that groups fall short of their maximum potential productivity because of “process losses” (Hill 1982; Gigone & Hastie 1997; Kerr & Tindale 2004). For example, Hill’s (1982) review found that group performance is often inferior to that of the best individual. Overall,

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1 Likewise, Linux essentially comprises self-organising community of programmers and companies where every code contribution is tested by various people and programming flaws are extirpated by members as they compile daily output (Evans & Wolf 2005). At Merrill Lynch, financial specialists leverage their own analytical skills through close interactions with others both in their own disciplines (e.g. acquisitions, high-yield financings, or equity markets) and across disciplines (Quinn et al. 1996).
Serena Alim

empirical findings in the literature do not provide compelling evidence of groups consistently outperforming individuals. Thus, strong justifications for using groups appear to be incomplete.

The objective of this study is to address the lack of research examining an important aspect of group decision-making, that is, group learning.² Despite the lack of compelling evidence of groups’ decision performance superiority over individuals, groups have been shown to excel in certain contexts. Prior studies have found that groups outperform individuals on tasks which require the utilisation of knowledge (Shaw 1976; Burton 1987). For example, in an audit setting, discussion between reviewer and reviewee was found to be beneficial for hypothesis generation (Ismail & Trotman 1995). Groups were also found to use a specific set of cues more consistently than individuals in predicting the likelihood of financial distress (Chalos & Pickard 1985). Using a concept formation task, Laughlin & Shippy (1983) found that groups required fewer feedback trials than individuals to identify correct inclusion rules.

This study investigates whether groups learn better than individuals in the presence of feedback and whether learning in a group leads to better transfer of learning. These research questions are of significant importance because learning is central to organisational performance and many resource allocation decisions are multi-period in nature (for example, costing and production level decisions, budgeting, variance analysis, long-term strategic planning, capital expenditure analysis, and continuous improvement initiatives to name a few). As highlighted by Atkinson et al. (1997, p. 4), “Management accounting information is one of the primary means by which operators/workers, middle managers, and executives receive feedback on their performance, enabling them to learn from the past and improve the future.” Thus, management accounting information serves as a critical input to many decisions involving a retrospective examination of prior decisions, with the objective of improving future performance (Sprinkle 2003).

In many settings, learning occurs through interaction with others (Barron 2000). For instance, at Microsoft, new software developers are assigned to small teams (Quinn et al. 1996). The pervasive use of groups in organisations initiates questions about the value of collaboration for improving decision performance in managerial tasks, many of which are characterised by a multi-period nature. In a management accounting context, the ultimate value of any management accounting practice is dependent upon the numerous benefits and costs relative to other systems or practices. The focus of this study is to investigate the impact of collaborative learning in the presence of different types of feedback.

Past research has shown that both the presence and the nature of feedback (e.g. type, precision, and timeliness) are important for learning (Gupta & King 1997; Briers et al. 1999). In particular, prior studies have examined the use of outcome feedback versus process-properties feedback. For example, Briers et al. (1999) found that providing decision makers with information about resource consumption patterns, referred to as process-properties feedback, improves performance as it helps identify root causes of the problems. In practice, managers receive periodical reports containing financial information about the level of performance or outcome associated with a particular period, which is commonly compared against expectations. When the outcome varies from expectations, feedback highlights discrepancies and managers may decide to take actions to resolve the problem. This standard type of feedback, referred to as the financial-performance feedback, only indicates the existence of problems. It does not directly assist the decision-maker to identify the nature and the root causes of problems. Therefore, the decision maker’s approach to modifying his/her decision strategy more likely follows a trial-and-error process (Briers et al. 1999). In contrast, additional feedback that helps the decision maker to understand the nature of

² In this paper, the terms “group learning” and “collaborative learning” will be used interchangeably.
the problem is likely to improve performance by directing the attention of the decision maker to the root causes of the problem.

This study extends prior research on feedback and learning by comparing group versus individual learning under two different feedback conditions. As prior research has found that groups use outcome feedback on a multiple-cue/choice task better than individuals (Tindale 1989), groups are expected to achieve higher performance relative to individuals. The superiority of groups over the average individual can be attributed to the rejection of errors (Shaw 1932), the recognition of correct responses proposed by at least one group member (Lorge & Solomon 1955), and the capacity of groups to process more information collectively than the average individual (Hinsz et al. 1997; Laughlin et al. 1998). Group discussion should be beneficial for decision performance as disagreements may allow for a more thorough examination of information (Nemeth 1986), and ideas suggested by other group members may facilitate the retrieval of other cues (Fisher 1987).

Further, the motivational approach to collaborative learning also suggests that learning in groups would enhance one’s interest in the subject matter. In this study, the value of collaboration is expected to vary as a function of additional feedback that is made available. The performance superiority of groups over individuals is expected to be greater when additional feedback which directs the decision maker’s attention to root causes of the problem is not made available.

This study also investigates the issue of whether knowledge gained from a learning task can be transferred to a similar task. The effect of collaboration on an individual’s acquisition of knowledge is assessed in terms of the individual’s subsequent performance on a transfer task. Individuals who worked in groups during the learning phase are expected to achieve higher performance on a transfer task relative to those who worked independently during the learning phase as collaborative learning is expected to result in better-elaborated, coherent representation of the subject matter. The advantage brought about by collaboration on transfer of learning is also hypothesised to interact with the provision of additional feedback during the learning phase.

The learning phase of this experiment uses a $2 \times 2 \times (8)$ (Collaboration × Type of Feedback × Decision Period) mixed factorial design. The first manipulated factor is collaboration (individual vs. group). The second factor is type of feedback, manipulated by varying the provision of process-properties feedback (financial-performance feedback only vs. financial-performance feedback in conjunction with process-properties feedback). The third factor, decision period, is a within-subjects factor. The dependent variable is profit performance on a learning task. The transfer phase of this experiment uses a $2 \times 2$ (Collaboration × Type of Feedback) between-subjects factorial design. The two between-subjects variables remain the same as those used in the learning phase. The dependent variable is profit performance on a transfer task.

2. THEORY AND HYPOTHESES DEVELOPMENT

2.1. Collaborative Learning

This study examines the role of collaborative learning on decision performance. Collaborative learning takes place when learners share common goals and responsibilities, are mutually dependent, and make judgments and decisions through open interaction and discussion (Van der Linden et al. 2000). It entails mutual interaction and the development of a shared understanding of a problem (Dillenbourg et al. 1996). Contemporary insights on learning suggest that collaboration during the learning process may have strong positive influences on learners’ acquisition of knowledge (Van der Linden et al. 2000).
The concept of collaborative, group, or team learning refers to “the acquisition of knowledge, skills, and performance capabilities of an interdependent set of individuals through interaction and experience” (Kozlowski & Ilgen 2006, p.86). When individuals learn collaboratively, making sense of a problem together, they are more likely to develop common frames of reference, to discuss issues as they seek to resolve divergence, and to come to a joint understanding (Miyake 1986; Roschelle 1992). In relation to collaborative learning, findings from both correlational and experimental studies have provided evidence that multiple kinds of processes are related to learning outcomes. These multiple processes include opportunities to explain one’s thinking (Cohen 1994; Webb et al. 1995), share knowledge (Coleman 1998), provide critique (Bos 1937), and engage in productive argumentation (Phelps & Damon 1989).

2.1.1. Theoretical Perspectives: Motivational and Cognitive Perspectives

Slavin (1996) differentiates two main theoretical perspectives to the study of collaborative learning. The first approach described by Slavin (1996) emphasises motivational explanations while the second approach emphasises cognitive explanations for the effects of collaboration on learning. The motivational approach asserts that a group motivates members to exert maximum effort as personal goals can only be attained if the group succeeds (Slavin 1995). It also asserts the importance of cohesiveness, where members help other group members as the group develops a team spirit and a sense of identification and concern for others (i.e. social cohesion, Cohen 1994; Johnson & Johnson 1998; Sharan & Sharan 1992). Findings of studies which focus on the motivational aspect of collaborative learning suggest that group discussion appears to positively influence learners’ intrinsic interest in the subject matter (Dolmans & Schmidt 2006). However, other researchers have argued that mere observation of group work provides individuals with many cognitive benefits that are important in the development of individuals’ knowledge structures (Levine & Moreland 1999; Webb 1992).

The cognitive approach to collaborative learning emphasises the role of cognitive elaboration that takes place during collaborative learning. According to the highly influential model of memory proposed by Atkinson & Shiffrin (1968), information in short-term memory enters long-term storage through elaborative rehearsal, which occurs when one engages in a subject matter by thinking about its meaning and relating it to other information already in long-term memory. Without engaging in such cognitive effort, information in short-term memory fades away and is lost. In contrast, simply repeating information silently to ourselves, known as maintenance rehearsal, does not necessarily transfer information from the short-term to the long-term memory. Therefore, elaboration is a strategy in which new information is linked to existing knowledge (Baron 2001).

In a collaborative learning situation, social interaction which fosters discussion has the potential to stimulate elaboration. Dyads have been found to generate more elaborative talk than individuals who worked individually and were asked to talk aloud (Teasley 1995). Teasley (1995) suggests that in discussing the problem with others, elaboration is enhanced as one communicates in order to be understood by the other, which results in more coherent explanations and accounts.

3 Slavin (1996) also discusses the developmental perspective, which will not be discussed here as it appears to be more applicable to research on children’s mastery of critical concepts. Although developmental and cognitive elaboration perspectives focus on different features of group interaction, both perspectives are based on the assumption that group interaction provides an opportunity for the development of members’ knowledge base (O’Donnell & Kelly 1994; Olivera & Straus 2004).

4 In the persuasion literature, elaboration is defined as “the extent to which an individual has carefully scrutinized and thought about the merits of information relevant to the attitude object” (Petty et al. 1995; Wegener et al. 1995).
Paying attention to the mutual support that learners can give each other, Webb (1991) found that giving elaborated help results in greater learning outcomes as learners create new relations by giving examples, using analogies, or referring to everyday experiences. Van Boxtel et al. (2000) further found that both students in each dyad actively reflect upon and elaborate not only their own understanding, but also the input of their partners.

As discussed above, if information is to be retained in memory and related to other information already in memory, the learner must engage in elaboration of the material (Wittrock 1986). Collaborative learning provides an opportunity for members to discuss and explain a subject matter to other group members, which represents one of the most effective means of elaboration (Slavin 1996). The cognitive elaboration perspective highlights the importance of verbal elaboration on the development and modification of individuals’ knowledge structures (Teasley 1997; Webb 1992). Facilitated by group discussion, verbal elaboration, which takes place as members ask questions and give explanations, has the potential to contribute to learning of both the help seeker and giver (Webb 1992). In studies investigating problem-based learning, group discussion has been found to stimulate activation of prior knowledge, recall of information, theory building and causal reasoning (Norman & Schmidt 1992; Dolmans & Schmidt 2006). Therefore, collaborative learning is expected to result in well-elaborated, coherent representations of the subject matter that are required to achieve improved performance.

Drawing upon both the motivational and cognitive approaches to collaborative learning, group discussion is expected to enhance learning about the causal relationships between resource consumption patterns and costs that are required to achieve improved performance in the learning task. Therefore, collaborative learning is expected to lead to greater performance of groups over individuals.\(^5\)

\(H1\): Compared to individuals, groups will achieve higher performance on a learning task.

### 2.2. Useful Feedback for Belief-revision

To investigate the value of group discussion on managerial learning, this study utilises a decision task where different types of feedback is made available. In their review of the effects of feedback interventions on performance, Kluger & DeNisi (1996) suggest that feedback influences the learning process by directing attention to differences between the decision maker’s hypotheses about the determinants of task performance and the outcomes that result from acting on these hypotheses. When feedback is not supplemented with cues which help the decision maker to reject erroneous hypotheses, the decision maker is likely to produce numerous hypotheses that may reduce consistency and thus decrease performance (Kluger & DeNisi 1996).

In this study, decision performance is sensitive to differences in knowledge of specific cost behaviour. To devise superior task strategies and thus improve decision performance, participants must understand the resource consumption patterns (cost behaviour) of different products. The additional feedback employed in this study, referred to as the process-properties feedback, enables the decision maker to derive accurate unit costs based on each product’s consumption of overhead activities. When only outcome feedback is available, performance may improve over trials but the decision maker is likely to follow a trial-and-error strategy.

\(^5\) The issue of whether groups can outperform individuals is generally studied via an examination of diversification and interaction effects. In this study, participants learn and make decisions together. Thus, there is no pertinent need to create statistical combinations of individual judgments (composite groups).
Briers et al. (1999) found that financial-performance feedback, which focuses on outcomes, does not directly help the decision-maker to understand and identify root causes of the problem and how the problem might be resolved. In contrast, process-properties feedback helps decision makers to better understand resource consumption patterns of products. Following Brier et al.’s (1999) findings, the provision of additional feedback in the form of process-properties information is expected to improve decision performance.

H2: Compared to those who received only financial-performance feedback, those who received process properties feedback will achieve higher performance on a learning task.

2.3. Interactive effect of collaboration and process-properties feedback on decision performance

Group discussion has been shown to activate prior knowledge, theory building, and causal reasoning (Norman & Schmidt 1992; Dolmans & Schmidt 2006). Prior research has found that groups use outcome feedback on a multiple-cue/choice task better than individuals (Tindale 1989) and that groups use a specific set of cues more consistently than individuals (Chalos & Pickard 1985). In concept learning, Laughlin (1965) found that two persons working together are more likely to use a more successful strategy than they would have working alone. Laughlin (1965) suggests that the opportunity for group discussion may have helped the groups to recognise and consequently adopt the more successful strategy. Likewise, Laughlin & Shippy (1983) found that groups required fewer feedback trials than individuals to identify correct inclusion rules in a concept formation task.

In this study, elaboration during the group interaction process is expected to allow group members to generate more potential solutions and to reject erroneous hypotheses concerning potential causes for discrepancies between actual and expected performance. More specifically, group discussion is expected to enhance learning about the causal relationships between resource consumption patterns and costs. Drawing upon prior findings that groups use a specific set of cues more consistently than individuals and that groups use outcome feedback better than individuals (Chalos & Pickard 1985; Tindale 1989), it is expected that groups will perform better than individuals despite the absence of process-properties feedback. In other words, by facilitating causal reasoning, collaboration is posited to help decision makers to better understand root causes of discrepancies between realised outcomes and expectations, similar to the function of process-properties feedback.

Thus, a directional interaction effect is expected such that the value of collaborative learning for improving decision performance will be greater when process-properties feedback is not provided. When decision makers are only provided with financial-performance feedback, the positive effect of collaboration is expected to be greater because elaboration facilitates the generation of hypotheses and the rejection of erroneous hypotheses concerning causal relationships between resource consumption and costs.

H3: The performance superiority on a learning task arising from the use of collaboration will be greater when process-properties feedback is not provided.

2.4. Transfer of Learning

At the individual level, learning involves “a relatively permanent change in knowledge or skill produced by experience” (Weiss 1990, p.72). Consequently, a measure of the learning construct at the team level needs to include each team member’s ability to individually acquire the
knowledge and skill that are required to successfully perform the task. More generally, an important outcome of learning is the ability to transfer knowledge to other contexts.

To further investigate the value of collaboration for improving learning and to provide a more comprehensive account of group effectiveness, this study also examines the effects of group learning on subsequent individual performance. From a practical point of view, an investigation of the extent to which members learn from groups has important implications as the nature of work teams in organisations is increasingly becoming even more short-term in orientation. Fast acting, temporary project teams have become common as individuals participate in multiple groups in organisations, either simultaneously or sequentially (Olivera & Straus 2004). Further, although using a group’s “best member” to solve problems may be more efficient in the short run, the use of interacting groups may well be more beneficial for organisations in the longer run as it provides an opportunity for various members to learn problem-solving strategies and to acquire useful skill and knowledge.

Benefits of collaborative learning may also transcend its local impact on a particular project to influence knowledge transfer to other areas of a manufacturing plant or other products (Lapré & Wassenhove 2002). It may also have further implications for transfer of knowledge and expertise in other settings such as auditing. In this study, the value of group collaboration on the individual member’s learning as a function of feedback is investigated via an examination of member performance on a transfer task. The transfer task involves the same principles as the learning task but is not identical to the learning task.

Following the discussion on collaborative learning in the preceding sections, it is hypothesised that individuals will benefit from group experience as members acquire knowledge of the more successful problem-solving strategy and an understanding of the problem throughout the course of group discussion and that this knowledge can be applied to subsequent individual tasks.

H4a: Individuals who worked in groups during the learning task will achieve higher performance on a transfer task compared to individuals who worked independently during the learning task.

Reiterating the value of providing information that helps decision makers to better understand resource consumption patterns of products, those who received process-properties feedback during the learning task are expected to perform better on a transfer task.

H4b: Compared to those who received only financial-performance feedback during the learning task, those who received process-properties feedback during the learning task will achieve higher profit performance on a transfer task.

Again, a directional interaction effect is hypothesised such that the value of collaborative learning during the learning task on transfer task performance will be greater when process-properties feedback was not provided during the learning task.

H4c: The performance superiority on a transfer task arising from collaboration during the learning task will be greater when process-properties feedback was not provided during the learning task.
3. RESEARCH METHODOLOGY

3.1. Participants

90 third-year accounting students will be recruited to take part in the study. Participants will be rewarded for their participation in the study. Participants’ pay structure will consist of a fixed as well as a performance-based component.

3.2. Experimental Procedures and Task Description

3.2.1. Learning task

Experimental sessions will be conducted in a computer lab, and will last approximately two hours. The learning task is adapted from Briers et al. (1999). The task is identical to Briers et al. (1999), but is computerised. The research instrument provides detailed descriptions of the firm’s production and market environments as well as its volume-based costing (VBC) system. The task requires participants to make pricing and production level decisions for two products, Alpha and Beta. Although each product is produced in different batch sizes and requires different machining times, the current costing system aggregates overhead costs into one pool and allocates costs based on the number of units. Therefore, participants need to understand the implications of the production process (thus resource consumption patterns of each product) to make adjustments to the cost information in order to make optimal decisions.

The procedures and the task remain the same for participants assigned to a collaborating group. In a collaborative work group, learners have a common goal and share both tools and activities (Webb & Palincsar 1996). They are simultaneously involved in completing the task and they possess a comparable prior knowledge level (Cohen 1994). Similarly, participants who completed the task as a group share a common goal, which is to maximise performance.

3.2.2. Post-learning knowledge questionnaire

At the end of the learning task, participants will be asked to complete a questionnaire. In addition to manipulation check questions (see Section 4.5), participants will be asked to complete a measure of cost behaviour knowledge. A six-item test was developed to assess participants’ knowledge of different aspects of the task. To measure their knowledge of cost behaviour, the following statements will be presented to participants, who will then be asked to indicate whether they agree with each of the statements: (i) the existing product-costing system aggregates the die change and machining overhead costs into one pool, (ii) the existing product-costing system inappropriately allocated overhead costs based on the number of units, (iii) Alpha was overcosted under the existing product-costing system, (iv) Beta was undercosted under the existing product-costing system, (v) Energy costs should be allocated to products on the basis of the number of machine hours that it takes to produce a unit for each product, (vi) Die change costs should be allocated to products in the following manner: Die change cost per batch is divided by the number of units in a batch to yield a rate per unit for each of the products. Each of the statements above is correctly stated. Participants will receive an overall knowledge score based on their performance in this section of the task.

3.2.3. Transfer task

To ensure that there are no wide discrepancies in the amount of work exerted by group members, before the transfer task is administered, each participant who was assigned to the group condition
Serena Alim

will be asked to rate the extent to which work was equally shared during the previous task (“How much work did you do relative to your team member during the previous task?”). Response options range from 0 to 100 (0 = “My team member did all of the work”, 50 = “We did equal amount of work”, 100 = “I did all of the work”).

The transfer task involves the same principles as the learning task but is not identical to the learning task. The background information to the transfer task states that the participant has been assigned a new project at another subsidiary company. Again, the task requires participants to maximise profit performance of the company. Analogous to the learning task, this company’s cost accounting system inappropriately allocates overhead costs based on the number of units. As a result, two products were undercosted while another one was overcosted. All participants are required to complete the transfer task individually.

This time, the participants will be given the demand schedules for a prior period. For that prior period, they will also receive information relating to the pricing decision (unit price and expected total sales in units) of a previous manager of the company and a feedback report, which outlines the outcome of that prior decision. Similar to the financial-performance feedback encountered during the learning task, this feedback report will show the actual total revenue, total costs, and profit which result from the previous manager’s decision. No additional process-properties feedback will be provided to any experimental condition. They will then be given the demand schedules for the current period. The task requires them to make a pricing/quantity decision for the current period. The participants will be asked to submit their decisions to the experimenter and each participant will then receive his/her remuneration.

3.3. Research Design

3.3.1. Independent variables

To investigate H1-H3, a 2 x 2 x (8) mixed factorial design will be used. The first between-subjects independent variable manipulated is collaboration (individual vs. group). Of the 90 participants, 30 participants will complete the task as individuals while 60 participants will complete the task in interacting two-person groups. The second between-subjects independent variable is the type of feedback provided (financial performance feedback vs. financial performance feedback in conjunction with process-properties feedback). There are eight decision periods for which participants will be asked to make product-related decisions.

To investigate H4a-H4c, a 2 x 2 between-subjects factorial design will be used. The two between-subjects variables remain the same as those for H1-H3. The transfer task involves only one decision period. Participants who have previously completed the learning task individually will be assigned to the individual treatment condition. Participants who have previously completed the learning task in two-person interacting groups will be assigned to the group treatment condition (although they will be required to complete the transfer task individually). In order to test H4a-H4c, participants who belong to each feedback condition for the learning task will remain in their corresponding allocation for the transfer task. Note that no process-properties feedback will be given to any experimental condition for the transfer task.

3.3.2. Dependent variables

The primary dependent variables are (1) Profit Performance on the Learning Task; and (2) Profit Performance on the Transfer Task for H1-H3 and H4a-H4c respectively. As the maximum profit
levels differ across periods, a normalised measure of profit will be used. The dependent variable “Profit Performance”, expressed as a percentage, is defined as follows:

\[
\text{Profit Performance in period } i = \frac{\text{Participant's Profit (i) - VBC Profit (i)}}{\text{ABC Profit (i) - VBC Profit (i)}}
\]

The measure of Profit Performance on the transfer task is consistent with the measure of Profit Performance on the learning task. This measure is also consistent with the dependent variable used in Briers et al. (1999).

Table 1. A Summary of Independent and Dependent Variables

<table>
<thead>
<tr>
<th>Type</th>
<th>Variables</th>
<th>Manipulation</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Independent variable</strong></td>
<td>Collaboration</td>
<td>Allocating participants to group vs. individual</td>
</tr>
<tr>
<td></td>
<td>Type of Feedback</td>
<td>Financial-performance feedback only vs. Financial-performance feedback + Process-properties feedback</td>
</tr>
<tr>
<td><strong>Dependent variable</strong></td>
<td>Profit Performance on Learning Task</td>
<td>(Participant's Profit - Profit based on volume-based costing)/(Profit based on activity-based costing - Profit based on volume-based costing)</td>
</tr>
<tr>
<td></td>
<td>Profit Performance on Transfer Task</td>
<td>(Participant's Profit - Profit based on volume-based costing)/(Profit based on activity-based costing - Profit based on volume-based costing)</td>
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</tbody>
</table>

3.3.3. Other variables of interest

Drawing upon the cognitive and motivational approaches to collaborative learning with the aim of providing further insights into potential sources of learning differences, several measures of elaboration and motivation will be used. Different measures that will be used to capture elaboration include the levels of effort and knowledge acquired from the learning task. In measuring effort, two widely used proxies are: (a) the amount of time the decision maker spent making decisions in each trial (e.g. Bettman et al. 1990; Sprinkle 2000); and (b) self-report of effort (e.g. Volet 1997; Iglesias-Parrot et al. 2002).

In this study, effort is first operationalised as the amount of time from the moment when subjects begin to acquire information to the moment when a decision is made in each trial. A second measure of effort used is a self-report of effort. This variable is included because Bettman et al. (1990) recommend the use of multiple measures of effort. To measure how effortful each decision was, participants will be asked to indicate how much effort was put into making the price/quantity decisions on a scale ranging from 0 (hardly any effort) to 10 (a great deal of effort). The level of knowledge is assessed via the post-learning knowledge questionnaire discussed above.

To capture the motivational impact of collaboration, a set of questions will be used to measure participants’ attitudes toward the task. The set of questions is adapted from Olivera & Straus’s
(2004) task motivation and task liking questionnaires and Miller et al.’s (1993) intrinsic valuing subscale. The resulting questionnaire consists of six items: “It was important for me to do a good job on this task”, “I did not care about how I did on the task” (reverse-scored), “The task was interesting”, “The task was fun”, “I enjoyed working on the task”, “Working on the task was personally satisfying”. Response options range from 1 = strongly disagree to 10 = strongly agree.

Both the self-report measure of effort and the motivation questionnaire will be administered after the learning task, directly prior to the administration of the transfer task.

<table>
<thead>
<tr>
<th>Approach</th>
<th>Variables</th>
<th>Measurement</th>
<th>References</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Elaboration</strong></td>
<td>Effort</td>
<td>Time spent making price/quantity decisions in each trial</td>
<td>Baiman (1982); Ellis et al. (1984); Bettman et al. (1990, 1993); Lohse &amp; Johnson (1996); Payne et al. (1996); Garbarino &amp; Edell (1997); Sprinkle (2000); Iglesias-Parro et al. (2001, 2002)</td>
</tr>
<tr>
<td></td>
<td>Self Report (Questionnaire)</td>
<td></td>
<td>Bettman &amp; Zins (1977); Bettman et al. (1990); Volet (1997); Iglesias-Parrot et al. (2001, 2002)</td>
</tr>
<tr>
<td></td>
<td>Knowledge score</td>
<td>Knowledge Questionnaire</td>
<td>Sidanius (1988); Wilson et al. (1989); Ford et al. (1998)</td>
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<tr>
<td><strong>Motivation</strong></td>
<td>Interest</td>
<td>Self Report (Questionnaire)</td>
<td>Brownell &amp; McInnes (1986); Nichols &amp; Miller (1994); Dolmans et al. (1998); Olivera &amp; Straus (2004); Tempelaar et al. (2007)</td>
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</table>

**3.4. Manipulation Check**

As one of the exit questions to the learning task, using the same response scale, participants will be asked to indicate the extent to which feedback received after each period caused them to question the usefulness of the unit costs for Alpha and Beta that were provided by the company’s cost accounting department when choosing the prices for these products. Participants will subsequently be asked if they had derived their own estimates of the unit costs for Alpha and Beta when making their pricing decisions. For those who had derived their own cost estimates, the next question asks participants to indicate the method used to arrive at these estimates.

**4. EXPECTED CONTRIBUTIONS**

Increasingly, practitioners emphasise the value of collaboration for organisational growth, proposing that intellectual assets are distinguished from physical assets as stimulated knowledge and intellect grow exponentially when shared (Quinn et al. 1996). The concept of leveraging intellectual assets via networks has become widespread in recent years, with a number of companies using self-organising networks known as spider’s webs.⁶ Correspondingly, collaborative learning which involves group problem-solving may augment the complexity and domain relevance of managers’ schemas. For example, collaborative learning by an interacting group of managers faced with the task of making product cost decisions has the potential to improve decision quality in an environment where costing systems are unsatisfactory. As a result, organisations that wish to facilitate learning may need to promote collaboration in managerial decision-making environments.

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⁶ A spider’s web brings a group of people together quickly to collaboratively solve a problem. The group is then disbanded once the work is completed (Quinn et al. 1996).
It is believed that research on the potential effects of collaboration on managerial learning that adopts an information-processing approach is inherently practical. In this paper, factors that may lead to group superiority have been suggested. This study aims to contribute to the academic literature and practice by investigating how feedback affects group learning. Unlike prior studies, this study also investigates whether learning can be transferred to a similar task and how this transfer of learning may be facilitated by collaboration. This study also seeks to provide further insights into why groups may outperform individuals in certain contexts. It is hoped that the framework and findings presented in this study will lead to a greater understanding of collaboration and its significance to organisations, as it may be one of our most valuable human resources.
References


